

# Governor's Water Augmentation, Innovation, and Conservation Council Non-AMA Groundwater Committee October 14, 2021



# Agenda

- I. Welcome and Recap – Rep. Gail Griffin and Jamie Kelley, Committee Co-Chairs
- II. 2021 Legislative Accomplishments
- III. Presentations on Enhanced Aquifer Recharge/Stormwater Harvesting
  - a. Enhanced Recharge Potential in Arizona – Keith Nelson; ADWR Senior Research Hydrologist
  - b. Efforts to Improve the Groundwater Aquifer Conditions in the Hualapai Valley Basin – Nick Hont, P.E.;  
Mohave County Senior Civil Engineer
- IV. Discussion of Committee Goals
- V. Next Steps
- VI. Adjournment



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# I. Welcome and Recap



*Rep. Gail Griffin and Jamie Kelley*  
*Non-AMA Groundwater Committee Co-Chairs*

## II. 2021 Legislative Accomplishments



*Rep. Gail Griffin*

*Non-AMA Groundwater Committee Co-Chair*

# 2021 LEGISLATIVE ACCOMPLISHMENTS

Non-AMA Groundwater Committee | October 14, 2021

Representative Gail Griffin

Chair, House Committee on Natural Resources, Energy & Water

Office: (602) 926-5895 | Email: [ggriffin@azleg.gov](mailto:ggriffin@azleg.gov)

# DROUGHT MITIGATION REVOLVING FUND

- Appropriated \$160 million
- Overseen by board representing different parts of the state whose members are appointed by the Governor, Senate President, and Speaker of the House
- Created to provide:
  - Grants ADWR can use to facilitate forbearance of water deliveries to avoid cuts to Arizona's Colorado River water supplies (up to \$10 million)
  - Grants to the State Land Department to help it make the best use of water resources on state trust land (up to \$10 million)
  - Low-cost, long-term loans for planning, designing, constructing, or financing water supply development projects to import water supplies into Arizona

# WATER SUPPLY DEVELOPMENT REVOLVING FUND

- Appropriated \$40 million, which represents the first permanent funding ever received, for projects outside AMAs (up to \$1 million per project)
- Increased the size of single grant for planning or designing water supply development projects to \$250,000
- Authorized it to fund water supply studies and planning, designing, building, or developing facilities
- Allowed stormwater recharge structures and macro-water harvesting projects to qualify for funding
- Allowed municipal water delivery systems, public water systems, NRCDs, and counties with less than 300,000 people to apply for funding
- Appropriated \$6 million for studies on importing water into Arizona



# ADDITIONAL APPROPRIATIONS

- Appropriated \$1.25 million to the Arizona Water Protection Fund, which provides grants for projects that protect water quality and quantity and restore riparian habitats
- Appropriated \$350,000 to the Arizona Department of Water Resources to study the hydrology and hydraulics of the Agua Fria River between New Waddell Dam to its confluence with the Gila River

# WATER RIGHTS MANAGEMENT

- HB2056/SB1368—Allows surface water rights holders to file a conservation plan notice with ADWR that describes conservation measures they will implement. Doing so exempts the water rights and claims in this notice from abandonment or forfeiture. This notice can be filed for up to 10 years and can be refiled.
- HB2441—Allows someone to permanently retire acreage from irrigation and substitute the same amount of acreage if the lands to be retired were either damaged by a flood or have a limiting condition and meet specified criteria.

# HEALTHY FOREST INITIATIVE

- SB1442 expands an existing program to remove hazardous vegetation by allowing the State Forester to sign agreements to remove this vegetation from federal, tribal and private lands if certain requirements are met and to use inmate recidivism reduction programs for forest restoration projects.
- FY 2022 budget appropriated \$3 million to the Department of Forestry and Fire Management (DFFM) for removing hazardous vegetation and \$784,400 for inmate firefighting crews
- The special session also appropriated to DFFM:
  - \$75 million for wildfire emergency response efforts, including fire suppression and mitigation projects to address postfire flooding
  - Nearly \$25 million for wildfire mitigation efforts across the state, including hazardous vegetation removal

QUESTIONS?

# III. Enhanced Aquifer Recharge/Stormwater Harvesting



*Keith Nelson, ADWR Senior Research Hydrologist*  
*Nick Hont, P.E., Mohave County Senior Civil Engineer*

# Enhanced/Informed Recharge

## What is Enhanced/Informed Recharge?

- Enhances the natural recharge process with the goal of introducing additional water to the aquifer, which may otherwise be lost.

## Where has enhanced recharge proven to be successful?

- Nogales, AZ/Santa Cruz AMA (SCAMA) - example of municipal water system that benefits from periodic, renewable flood recharge and proactive water management

## Other areas where potential enhanced recharge could be *physically* feasible (regardless of other considerations)?

- Potential for enhanced flood recharge in the Prescott AMA
  - Granite Creek, Lynx Creek



# Enhanced/Informed Recharge Potential in Arizona

## Why is this important?

- Many groundwater flow systems in AZ are in **overdraft**

## What other benefits?

### 1) Interested in **recharging precipitation** that otherwise evaporates

- Precipitation-Evaporation rate is **98%** in
  - Prescott AMA (NARGFM)
  - Willcox, Tucson, DRAFT Upper San Pedro & Draft San Simon
- Precipitation-Evaporation rate is **89%** in SCAMA

### 2) Induced recharge has the potential to **mitigate flood damage**; increasing urbanization

Can use regional-scale groundwater flow models to inform recharge location

All recharge sites are NOT equal!



## Prescott AMA

$$\Delta S_{1939-2019} \approx -7,300$$

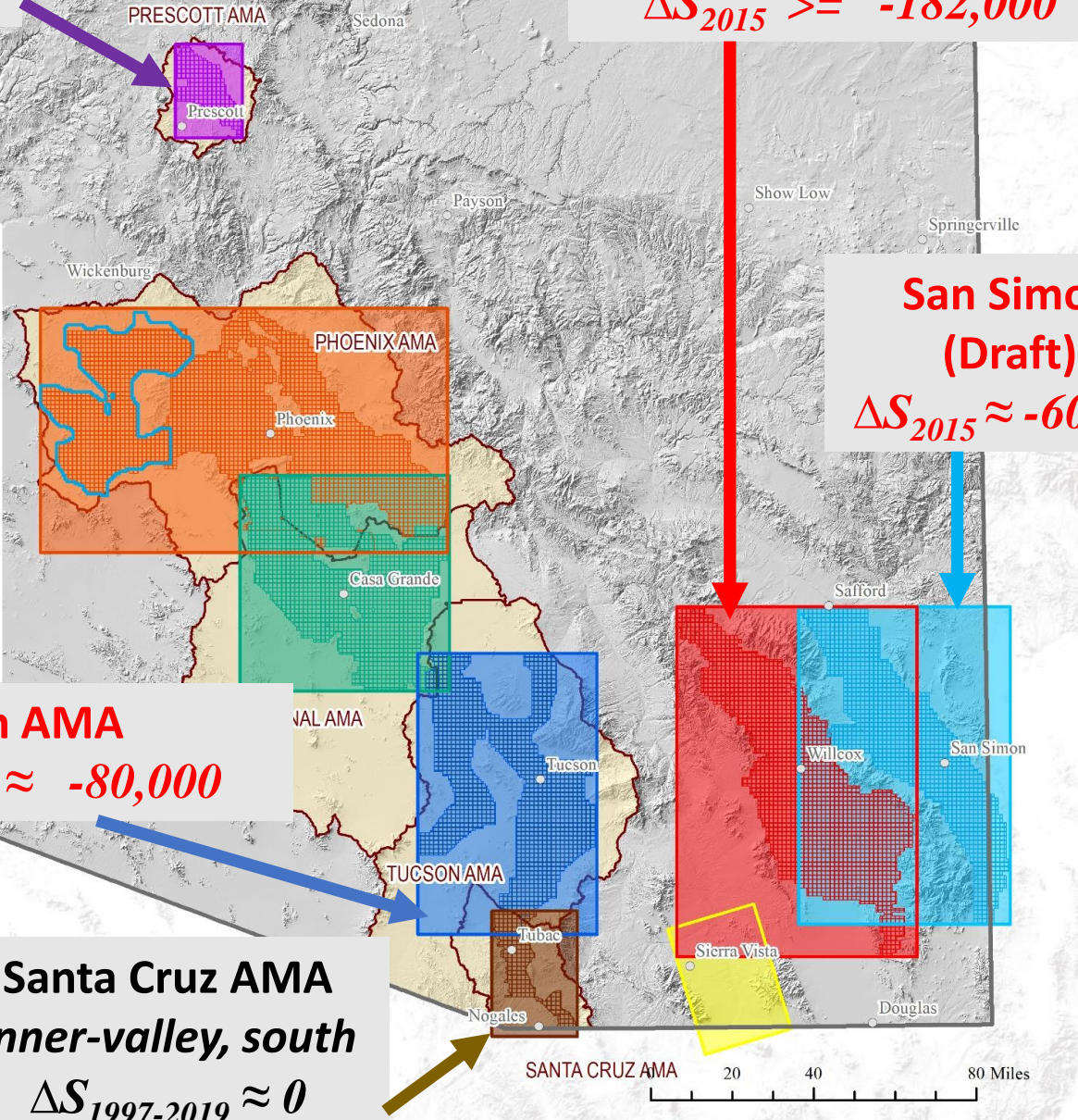
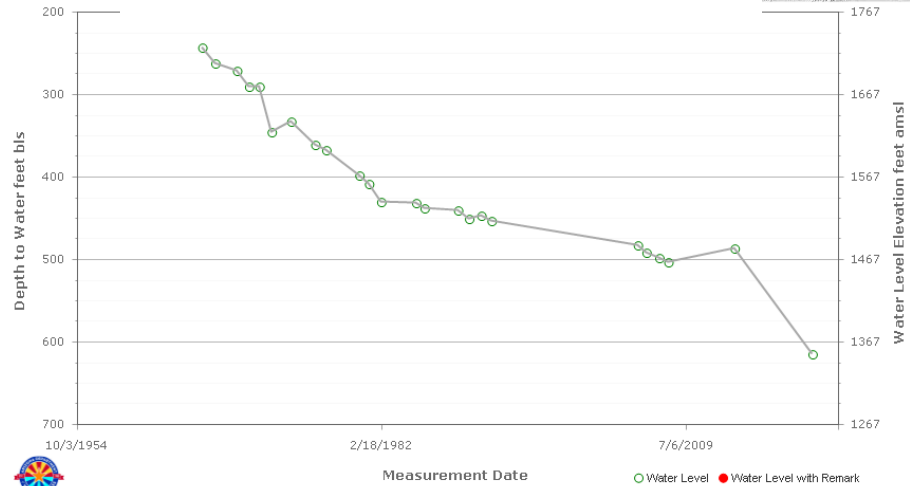
Water Models - Arizona Department of Water

## Willcox

$$\Delta S_{1940-2015} \approx -76,000$$

$$\Delta S_{2015} \geq -182,000$$

## McMullen Basin



## San Simon (Draft)

$$\Delta S_{2015} \approx -60,000$$

## Tucson AMA

$$\Delta S_{1940-2018} \approx -80,000$$

## Santa Cruz AMA Inner-valley, south

$$\Delta S_{1997-2019} \approx 0$$

### Explanation

Active Management Areas

### ADWR Model Areas

- |  |          |  |            |
|--|----------|--|------------|
|  | Pinal    |  | San Pedro  |
|  | Prescott |  | San Simon  |
|  | SRV      |  | Santa Cruz |
|  |          |  | Tucson     |
|  |          |  | Willcox    |
|  |          |  | Yuma       |
|  |          |  | Hassayampa |

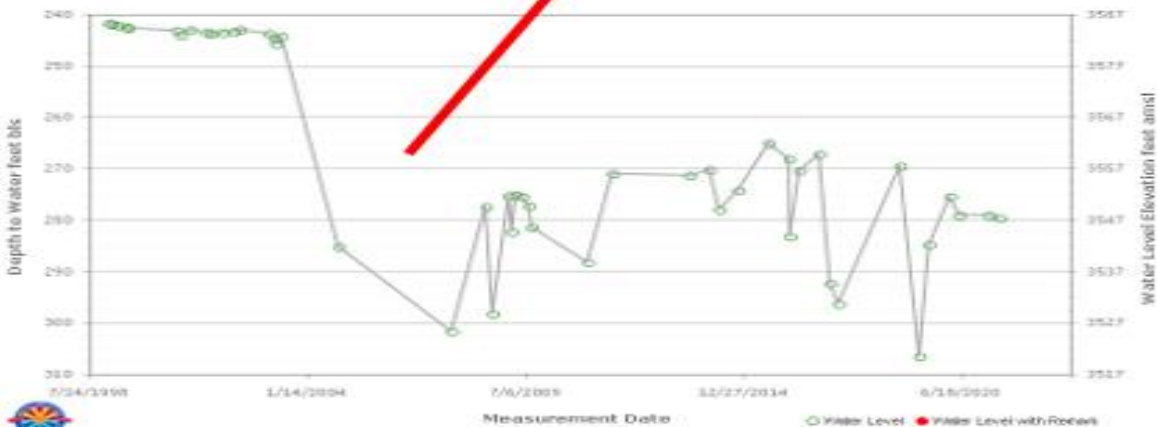
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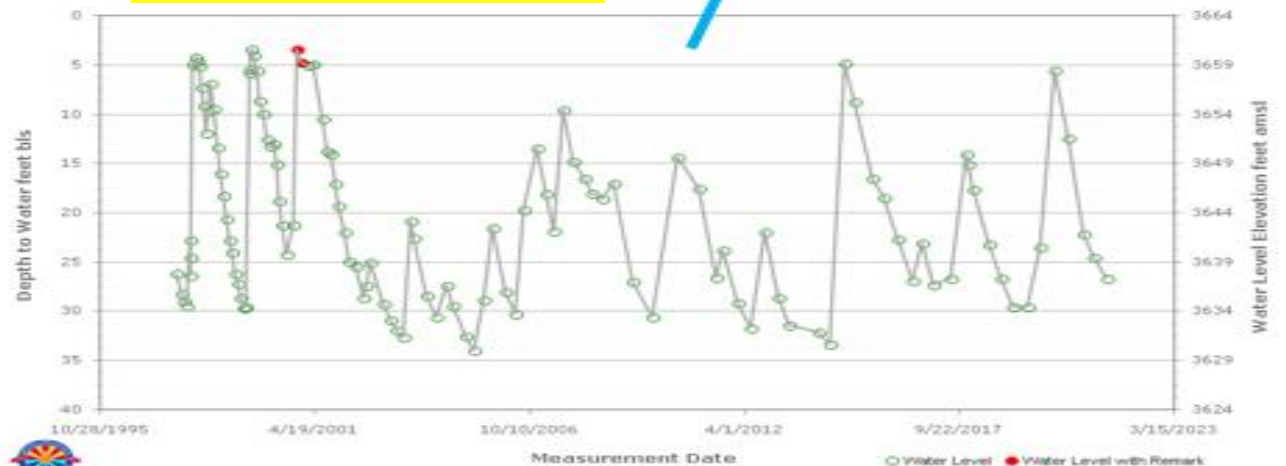
## Example of Successful Enhanced Recharge: City of Nogales/Santa Cruz AMA (SCAMA)

Dynamic operations of well fields leads to induced recharge in the SCR aquifer, allowing Santa Cruz subbasin GW withdrawals to reach long-term dynamic equilibrium. Bc Potrero recharges at different rates {Note – the “system” can be broken}

### Potrero Well Field *Modest recharge*

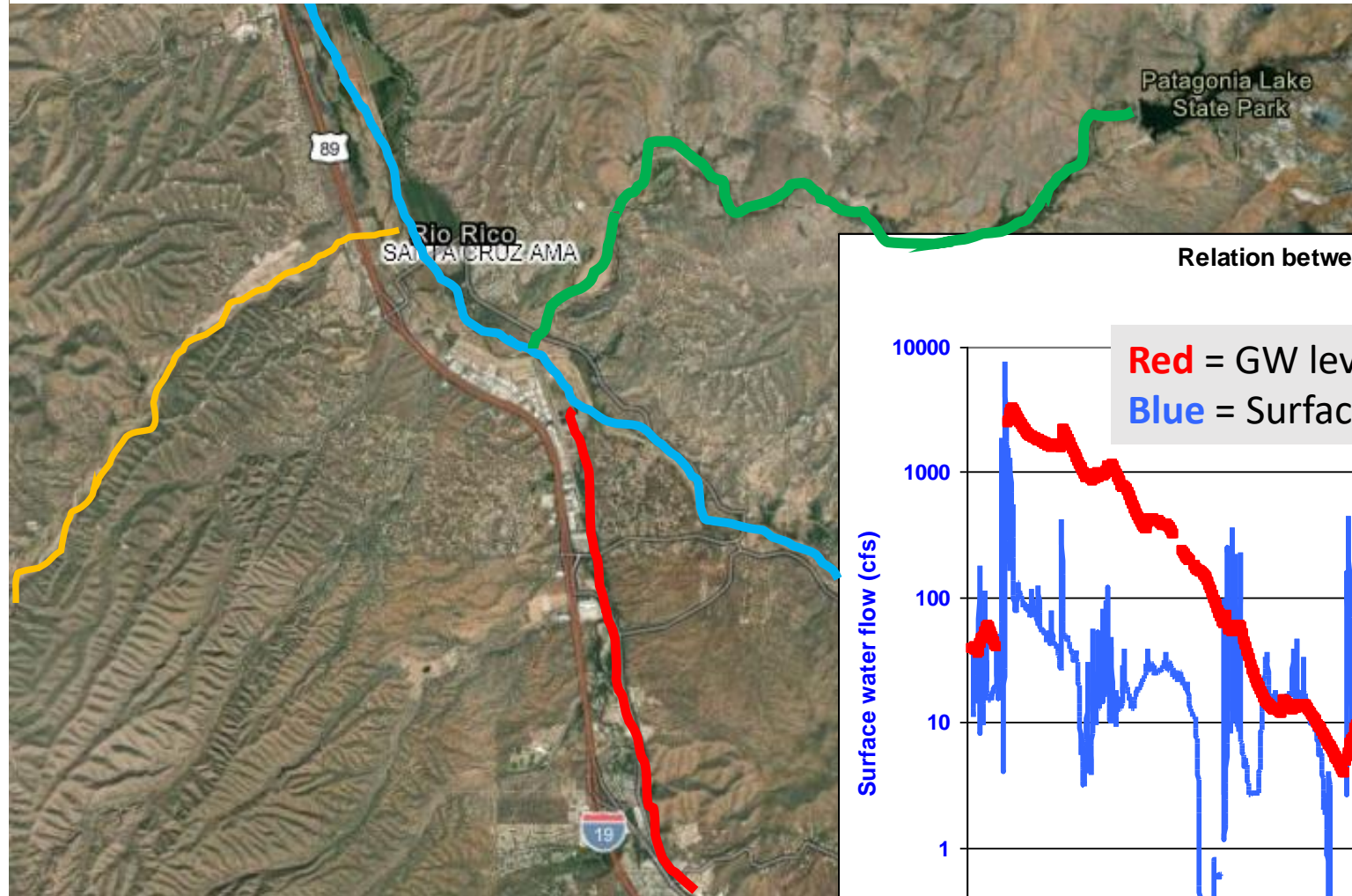


### SCR Well Field *Rapid Infiltration/Recharge*

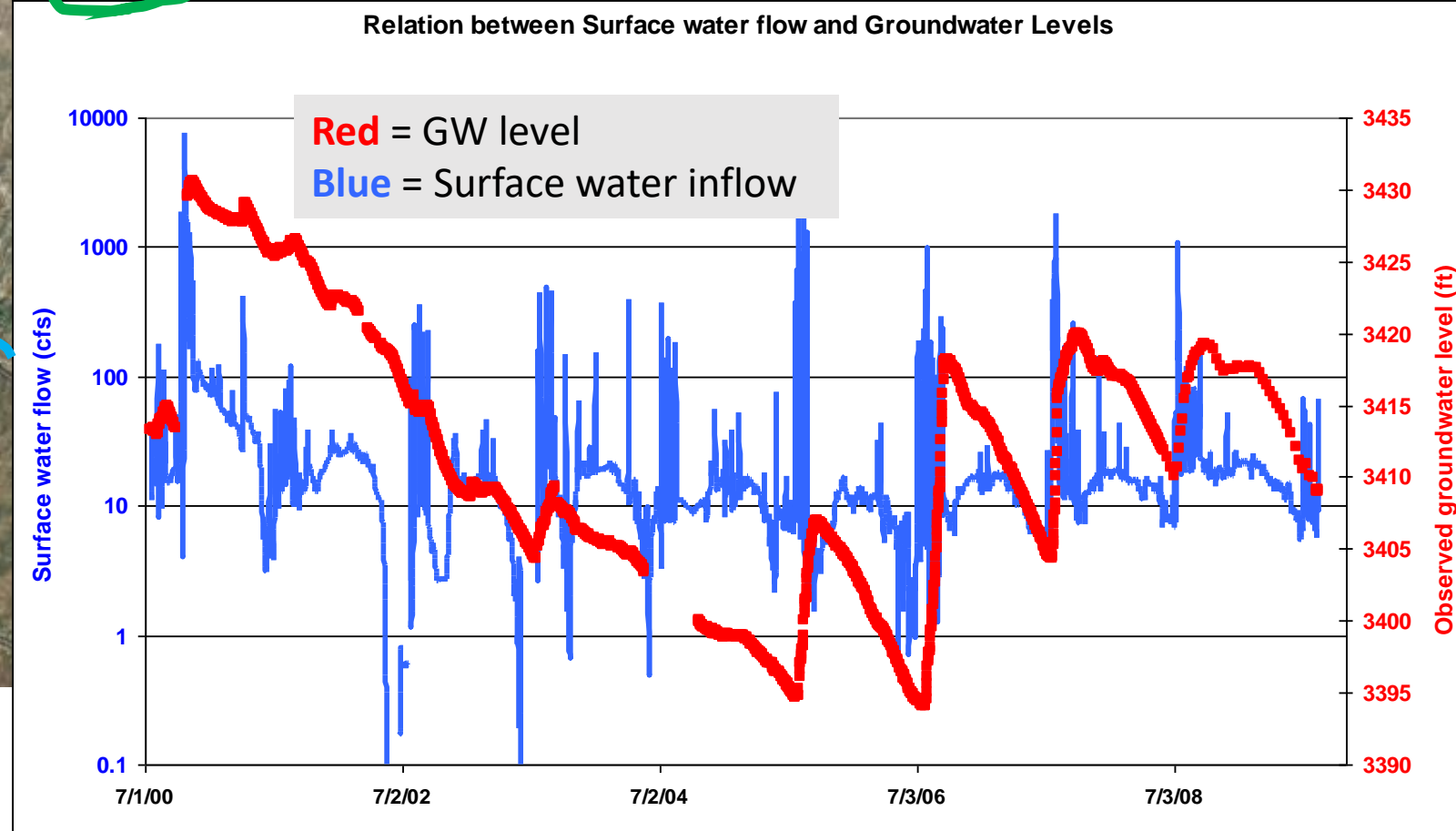




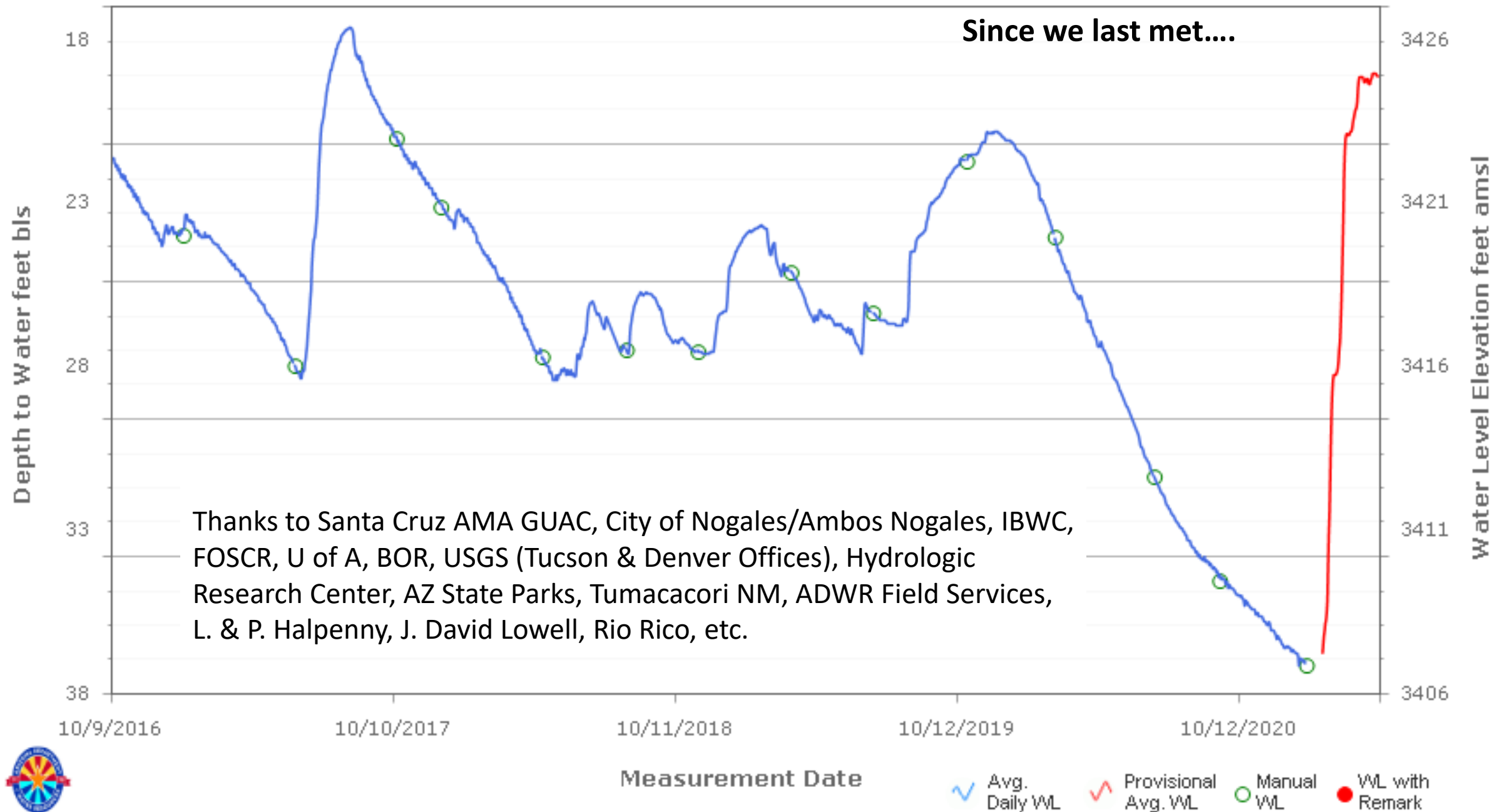
# Why Does It Work So Well?



Tres Rios: Santa Cruz River  
(mainstem), Nogales Wash,  
Sonoita Creek and Agua Fria  
Creek



GW levels decreasing from 2000 to approx. 2005. In 2005 GW level start increasing. Highlights potential to offset withdrawals with increased flood water recharge.

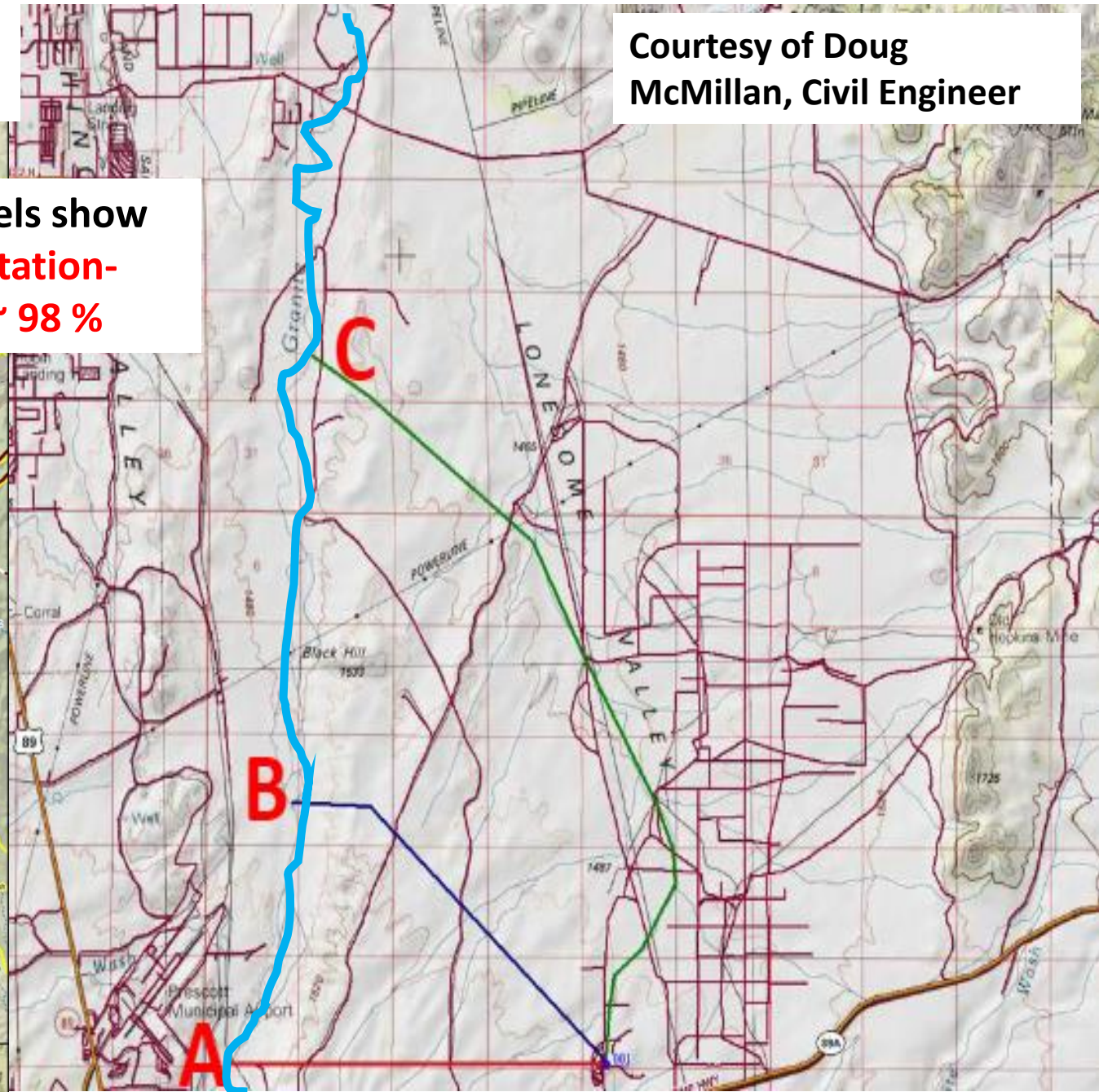
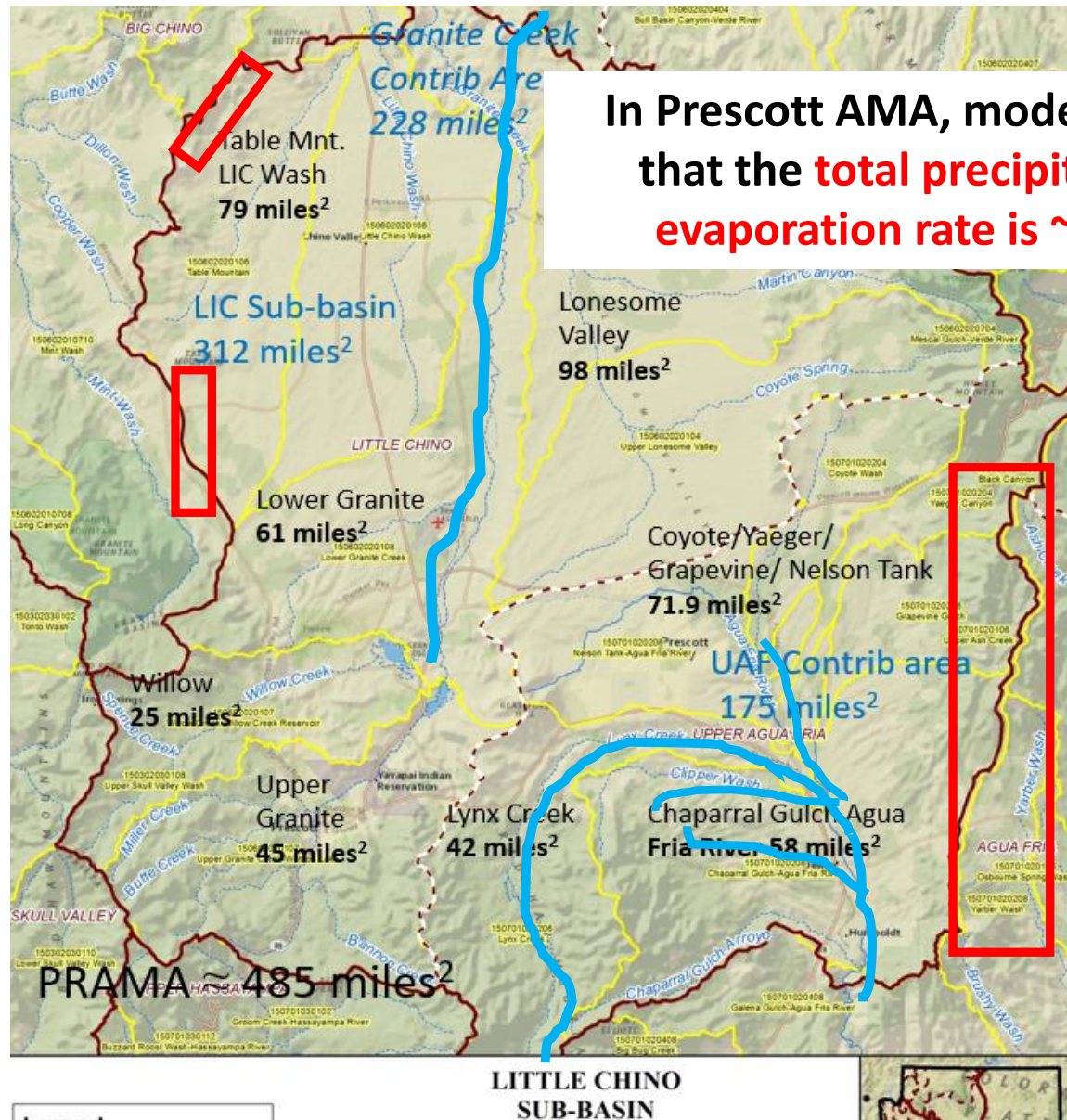




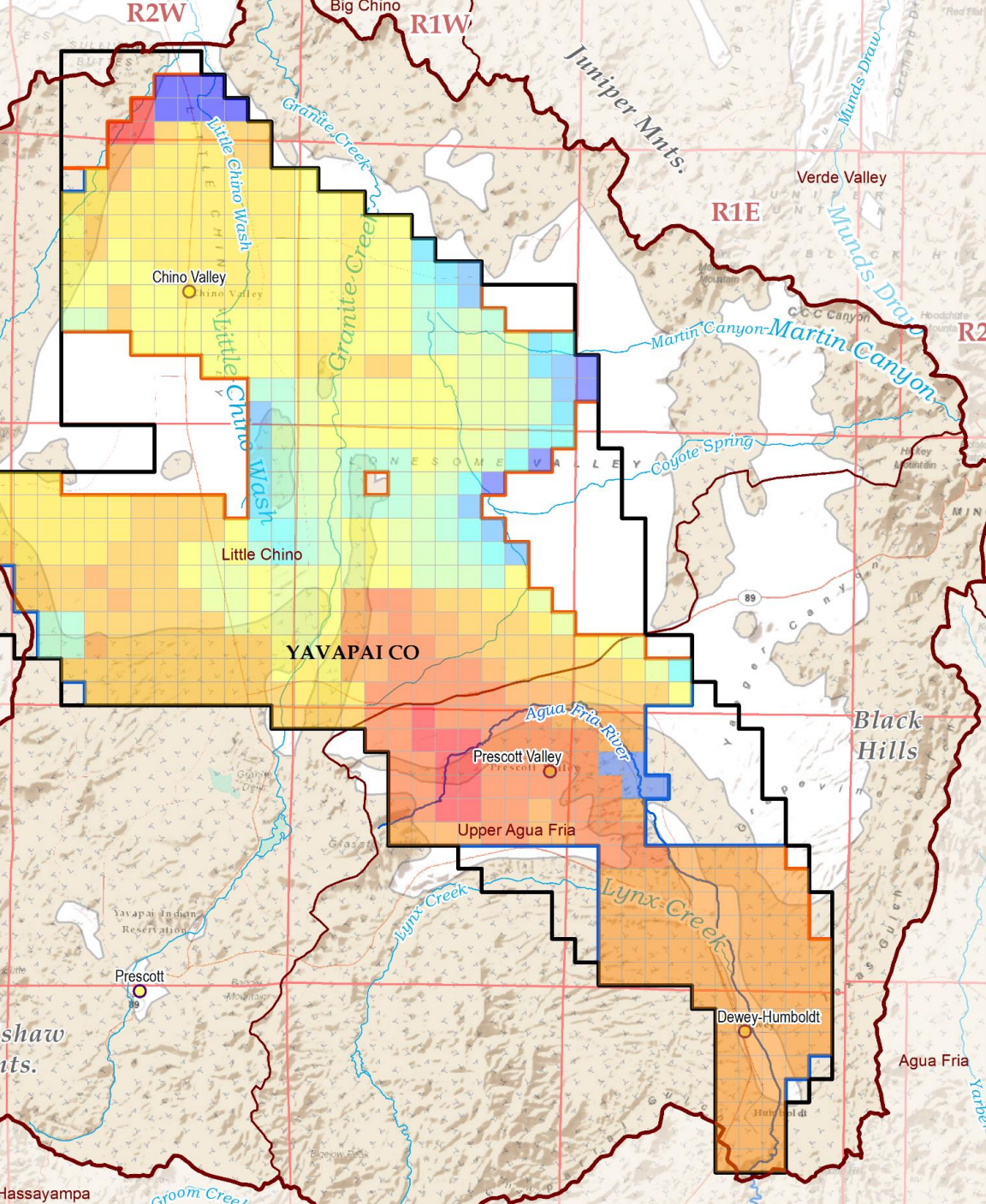
Enhanced Recharge Potential in the Prescott AMA:  
reduce loss due to evaporation by directing runoff  
to locations where recharge is *physically feasible*

Courtesy of Doug  
McMillan, Civil Engineer

In Prescott AMA, models show  
that the **total precipitation-  
evaporation rate is ~ 98 %**







## Upper Verde River Watershed Protection Coalition

Prescott AMA

Yavapai County

Yavapai-Prescott Indian Tribe

City of Prescott

Town of Chino Valley

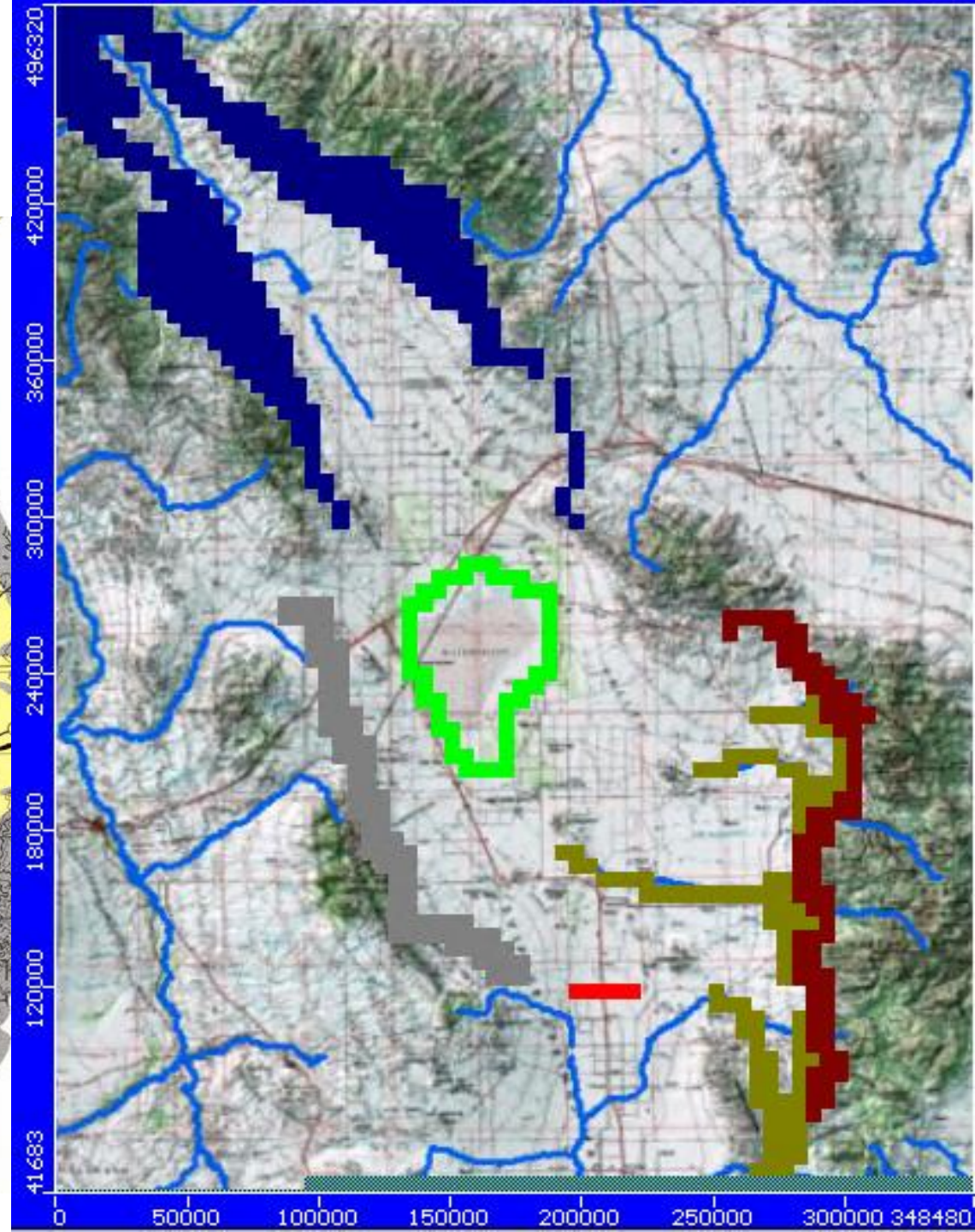
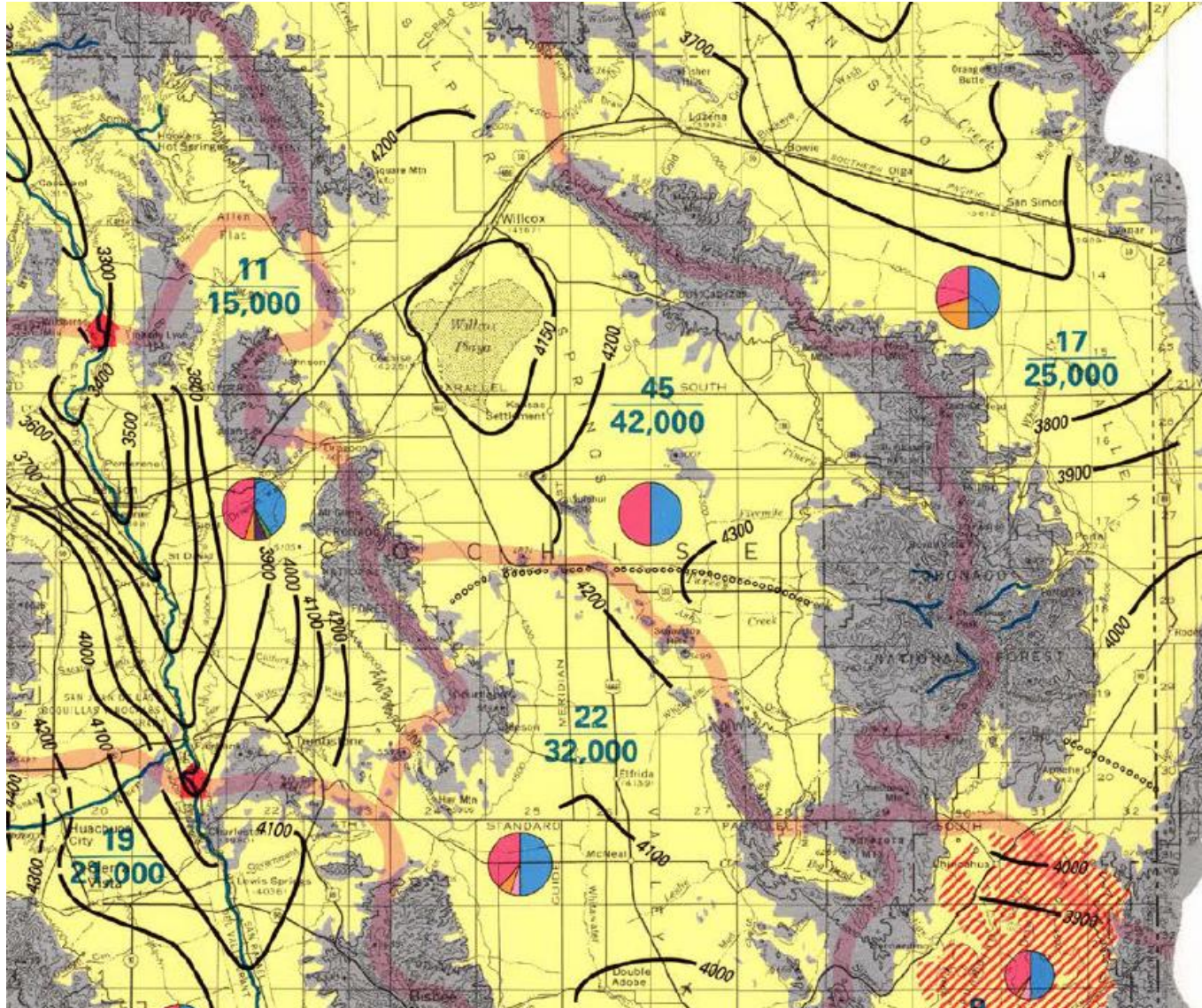
Town of Prescott Valley

It is a grant funded group whose goal is to reach safe-yield in the Prescott AMA and preserve the flows of the Upper Verde River. The Coalition developed a Watershed Restoration Plan in 2014 which has been instrumental in generating around \$7.6 million for on-the-ground projects that will increase natural recharge

Recently, the Coalition has adopted a **Stormwater Initiative** that will work to unify the stormwater management approach among the Coalition Members with a focus on not only public safety but to allow **stormwater to recharge the aquifer** rather than be disposed as a waste product. We are currently working to fund the first phase of this - a study of current practices and an implementation plan for BMPs.



Potential for type of recharge varies, depends on hydrogeology  
**Mountain front recharge (MFR)** vs. **Concentrated flood recharge**  
**Willcox & San Simon** vs. **Upper Santa Cruz; Upper Agua Fria; Gila**







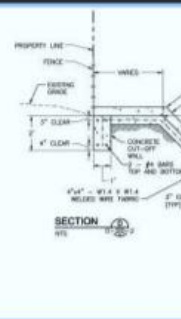
Mohave County Development Services



# Hualapai Valley Basin Groundwater Aquifer Conditions and Engineering Efforts for Improvements

February 20, 2018

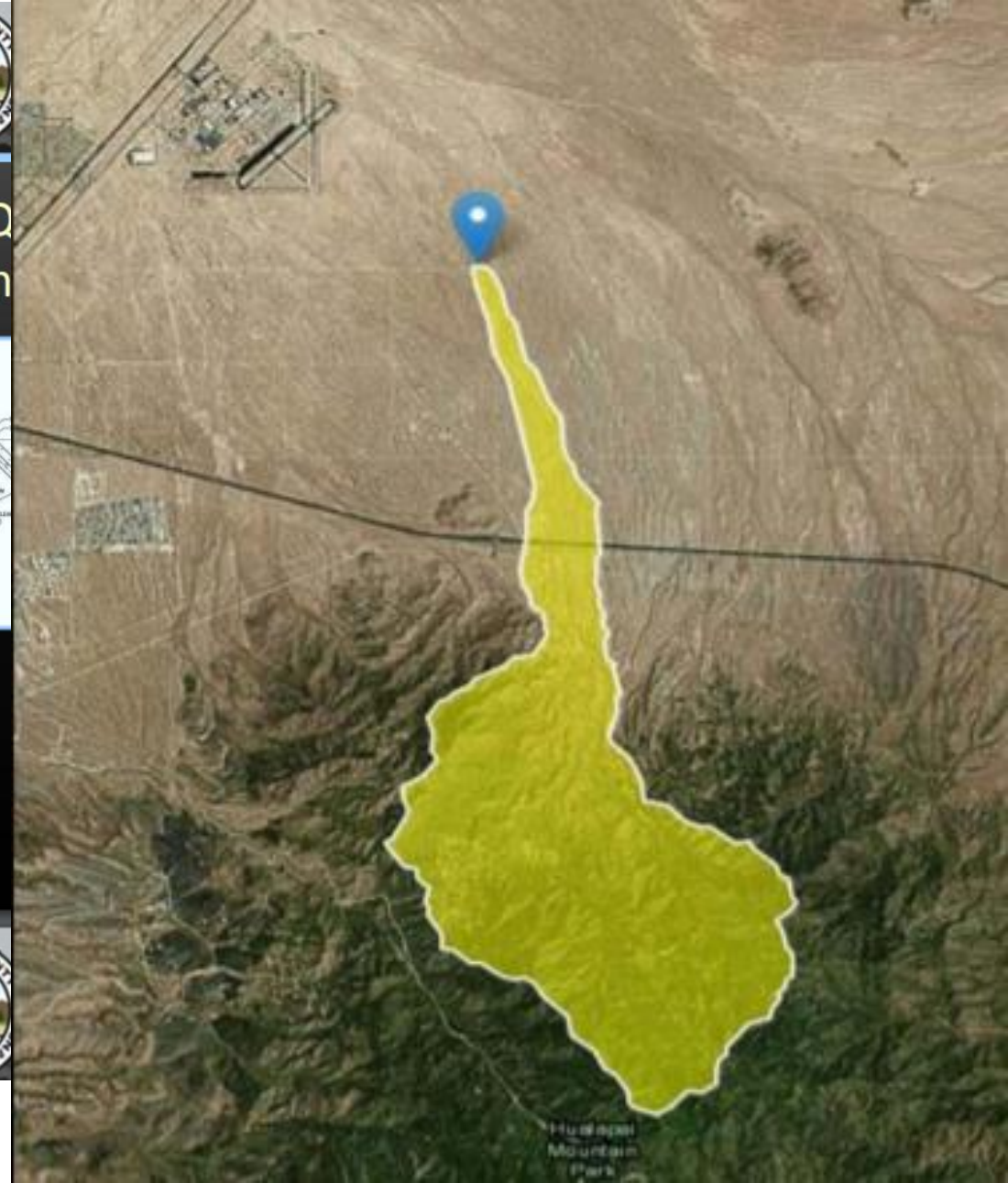
Nick Hont, P.E.  
Senior Engineer  
Mohave County



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Mohave County Development Services





Mohave County Development Services

# Efforts to Improve the Groundwater Aquifer Conditions in the Hualapai Valley Basin

November 14, 2021

Nick Hont, P.E.

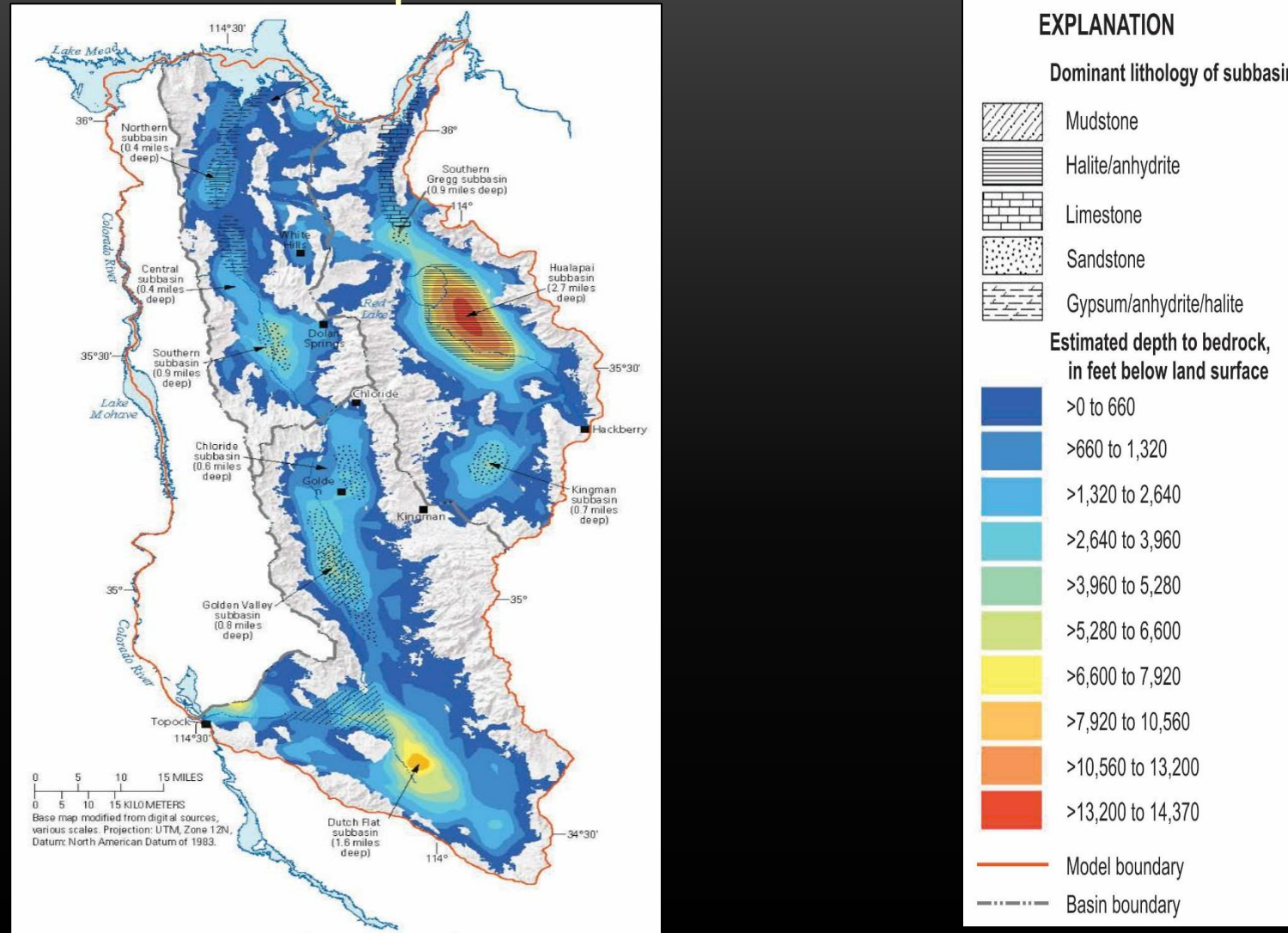
Senior Engineer

Mohave County





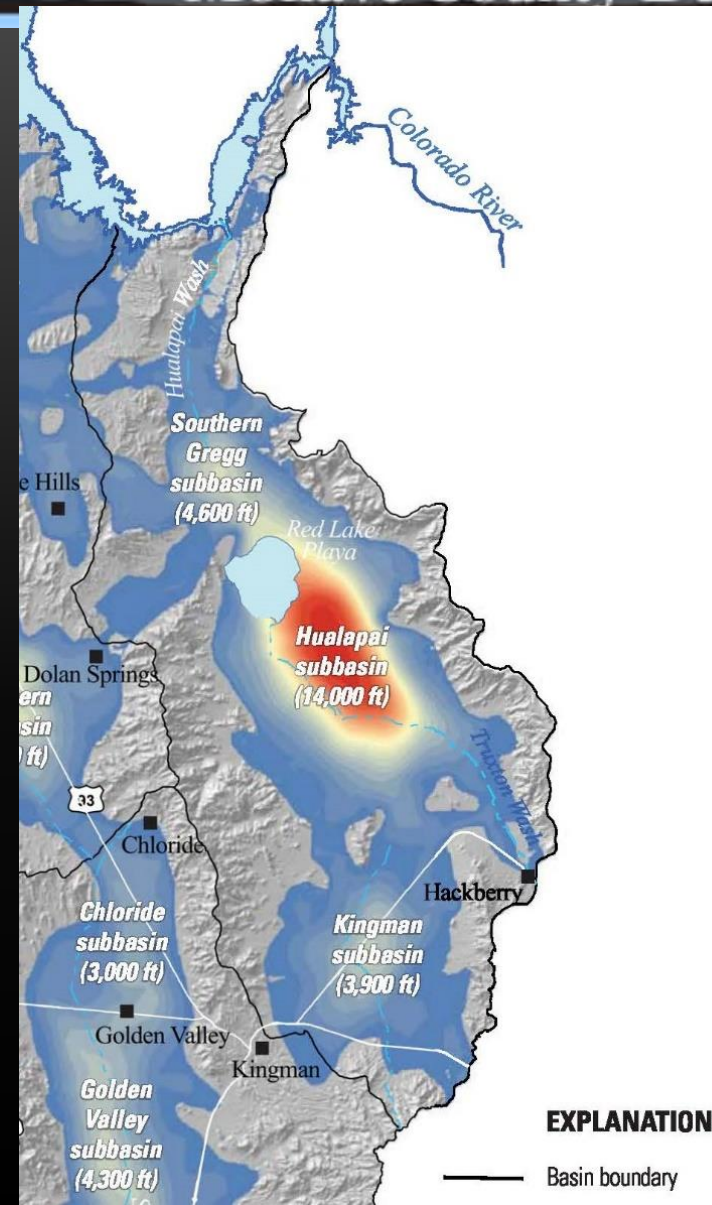
## Basin-Fill Aquifers of Mohave County





Mohave County Development Services

# Hualapai Valley Groundwater Basin





## Groundwater Budget; Annual Water Deficit

According to USGS estimate, in 2011 the annual Inflow to the Aquifer (recharge) was 9,900 acre-feet; Outflow from the Aquifer (discharge) was 15,500 acre-feet, thus creating an **annual water deficit of 5,600 acre-feet**

*(Reference: USGS Scientific Investigations Report 2013-5122; Preliminary Groundwater-Flow Model of the Basin-Fill Aquifers in Detrital, Hualapai, and Sacramento Valleys, Mohave County, Northwestern Arizona)*

According to AWRD estimate, in 2016 the annual agricultural use of groundwater, and the associated outflow (discharge) from the Aquifer increased by an additional 32,000 acre-feet, thus **increasing the annual water deficit in the Aquifer to 37,600 acre-feet**

*(Reference: AWRD Northwest Basins Planning Area Water Demand Update, Stakeholders Meeting, May 18, 2017)*

**Table 2 Groundwater-budget values for Hualapai Valley, Mohave County**

[acre-ft/yr, acre-feet per year; maf, millions of acre-feet; <, less than; WWTP, waste domestic; ET, evapotranspiration]

Water-budget component	This study	
	Inflow to aquifer (acre-ft/yr)	Outflow from aquifer (acre-ft/yr)
Natural recharge	5,700	
Mountain-block recharge	4,400	
Truxton Wash stream-channel recharge	600	
Other ephemeral stream-channel recharge	400	
Underflow at Truxton Wash	300	
Natural discharge		5,700
to Lake Mead		5,700
Phreatic ET		<300
Groundwater withdrawals		9,800
City of Kingman municipal		7,600
CWS		500
SSD		500
Interbasin transfer		1,200
Incidental recharge	4,200	
Infrastructure leakage	500	
Septic systems	3,000	
Treated WWTP effluent	800	
Totals	9,900	15,500





## Limited Natural Recharge

**Table 4.** Agricultural groundwater pumpers and projected annual withdrawals (in acre-feet).

Farm ID (figure 17)	Water demand estimate in 2019	Water demand estimate in 2024	Water demand estimate in 2029
1	0	36,720	64,260
2	22,550	26,400	30,250
3	2,430	4,050	13,500
4	0	6,372	11,151
5	0	2,808	4,914
6	1,080	1,728	3,024
7	0	972	1,701
Total	26,060	79,050	128,800

Water-budget component	This study	
	Inflow to aquifer (acre-ft/yr)	Outflow from aquifer (acre-ft/yr)
Natural recharge	5,700	
Mountain-block recharge	4,400	
Truxton Wash stream-channel recharge	600	
Other ephemeral stream-channel recharge	400	
Underflow at Truxton Wash	4300	
Natural discharge to Lake Mead		5,700
		5,700

- The estimated water use by farmers is anticipated to increase to 128,800 acre feet in 2029

*(Ref: USGS Scientific Investigations Report 2021–5077 Assessing Potential Groundwater-Level Declines from Future Withdrawals in the Hualapai Valley, Northwestern Arizona)*

- **The Annual Natural Recharge is only 5,700 acre-feet**

*(Reference: USGS Scientific Investigations Report 2013-5122; Preliminary Groundwater-Flow Model of the Basin-Fill Aquifers in Detrital, Hualapai, and Sacramento Valleys, Mohave County, Northwestern Arizona)*



## Mitigating Measures Initiated by Mohave County

1. Mohave County contracted with the United States Geological Service (USGS) for developing a **detailed subsurface hydrology model** to establish the groundwater conditions. The project costs were funded jointly by Mohave County and the City of Kingman with contribution from the USGS. The model has been completed and is accessible at:  
[Assessing potential groundwater-level declines from future withdrawals in the Hualapai Valley, northwestern Arizona \(usgs.gov\)](#)
2. Mohave County has begun a **stormwater infiltration program** through the Mohave County Flood Control District that aims to facilitate increased infiltration into the Aquifer by engineering methods.



# USGS Model to Establish the Groundwater Conditions

The hydrology model will be used as an engineering tool to predict:

1. The impact of the increased well pumping in specific areas of the Basin;
2. The anticipated time frames for the drop of groundwater levels in specific areas of the aquifer; and
3. The impact of mitigating measures, such as Mohave County's stormwater infiltration projects.

Mohave County will provide input to future scenarios of the hydrology model by:

- a. Locating areas where the County is most concerned with future drawdown, such as the City of Kingman's well field, etc.; and
- b. Providing the locations of potential enhanced infiltration areas.



# Flood Control District Stormwater Infiltration Program

The dual benefits of the stormwater infiltration program are (1) to eliminate or reduce flood related hazards and erosion repairs on infrastructure, and (2) to facilitate increased infiltration into the Aquifer.

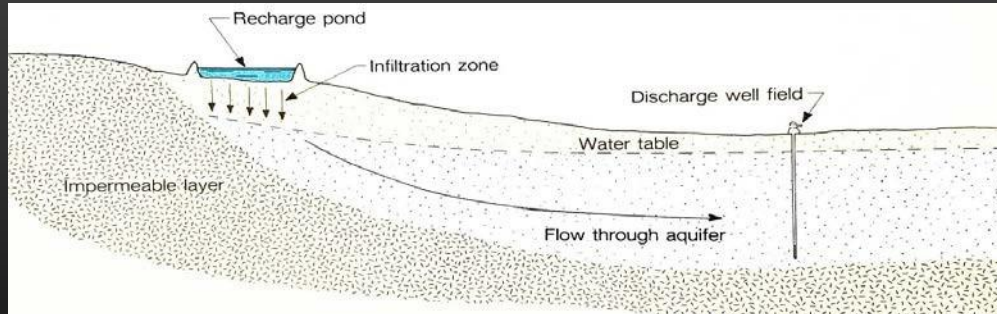
## **Methods to Facilitate Enhanced Infiltration into the Aquifer:**

- Shallow or Spreading Infiltration Basins, which may be developed by spreading the water on the ground surface over a large area; or enhanced by excavation and berms;
- Deeper Infiltration Basins, constructed by excavation and placement of free-draining gravel and possibly enhanced with dry wells or vadose zone wells; and
- Injection Wells.

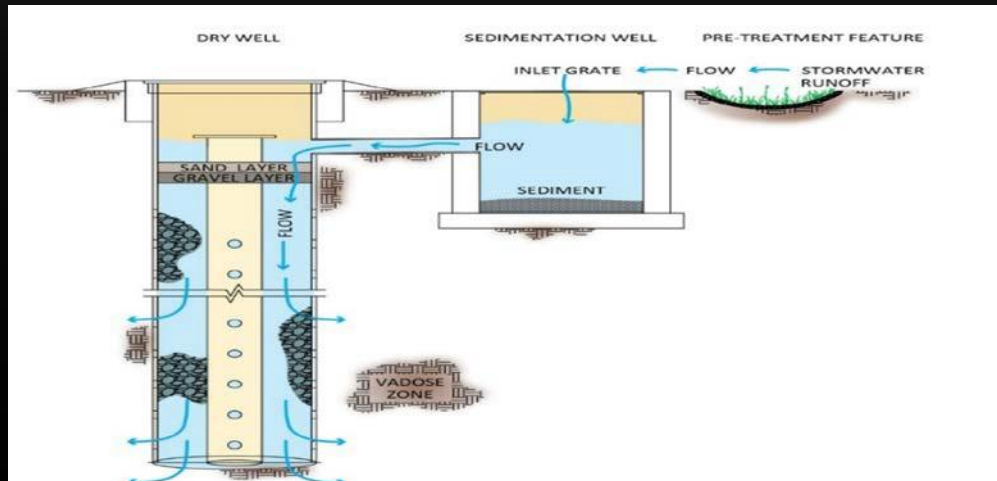




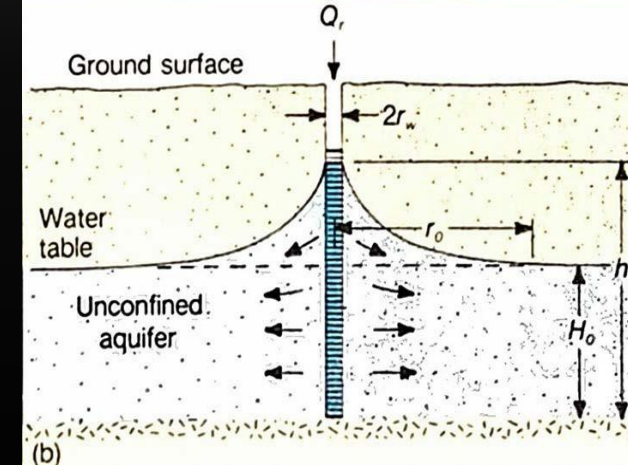
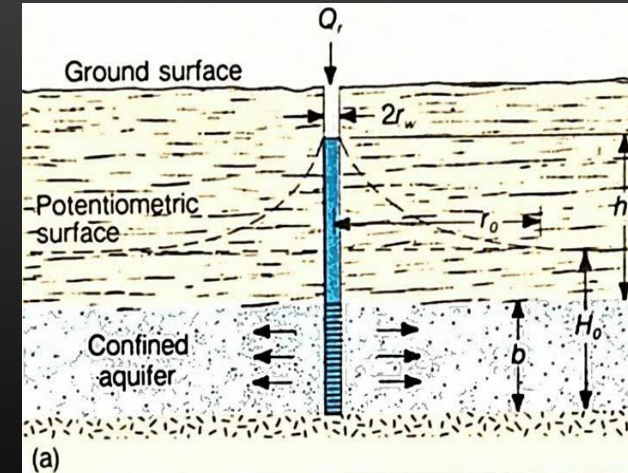
# Methods to Facilitate Enhanced Infiltration



Ponds with Gravel Infiltration Pits



Dry Wells or Vadose Zone Recharge Wells

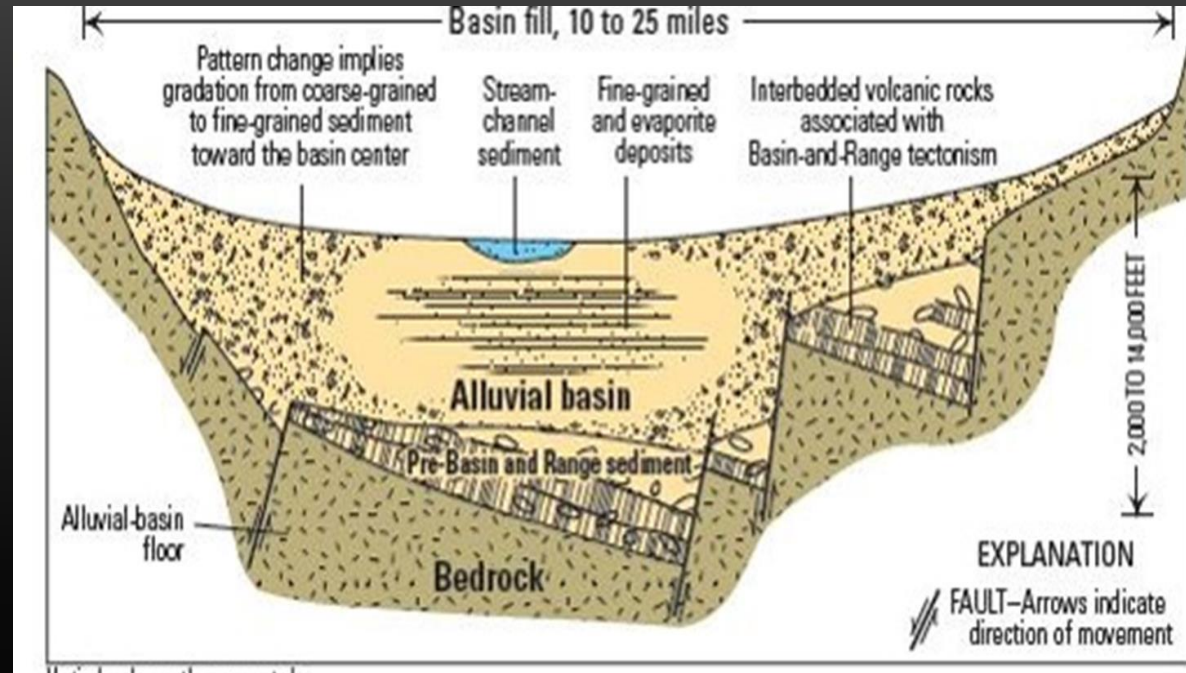


Injection Wells





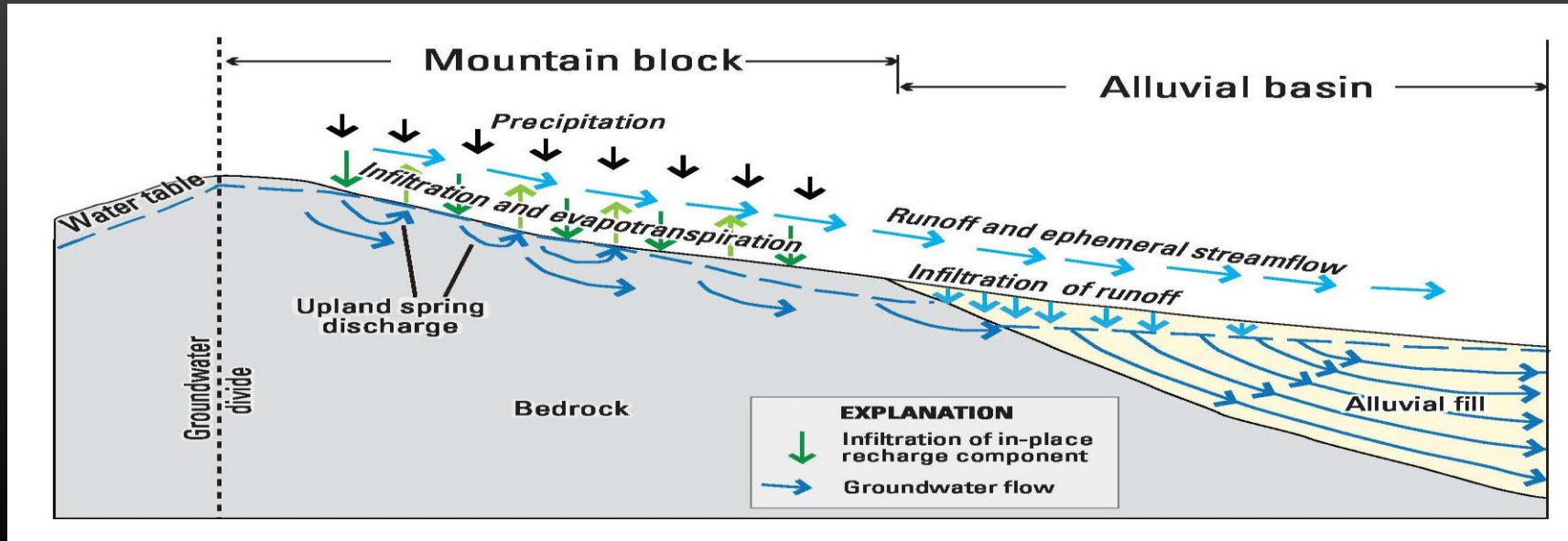
## Geology and Hydrology Background



- Mohave County's Basin and Range, basin-fill type aquifers consist primarily of sediment-filled basins separated by mountain ranges
- Basin-fill deposits typically range from about 1,000 to 7,000 feet in thickness but are thinner or thicker in some locations
- Groundwater is mostly unconfined



## Natural Recharge



- Recharge in the alluvial basin fills is limited due to the fine-grained sediments
- Groundwater is mostly recharged from infiltration of mountain streams along the foothills of the mountains
- The anticipated natural recharge is only 5,700 acre-feet compared to the annual discharge in the future exceeding 100,000 acre-feet
- Enhanced infiltration/recharge will improve the balance



## Legal Criteria

1. Check on potential surface water right allocations (State Regulation); and
2. Waters of the U.S. designations (Federal Regulation)

## Feasibility Evaluations for Site Selection

1. Locate major washes in hills surrounding the Basin
2. Find suitable and affordable properties along washes
  - County and City right-of-ways and drainage parcels
  - BLM lands
  - private property donations
3. Engineering assessment of
  - storm water flow and quantities,
  - geotechnical properties and infiltration capacity of the subsurface soils, and
  - feasibility/cost of construction



## Engineering Work

1. Site hydrology to determine the anticipated surface flow and quantities (2% to 10% annual probability)
2. Hydrologic calculations for the available amount of rechargeable water
3. Geotechnical engineering evaluations of the subsurface soils
4. Sites containing underlying subsurface soils of clean sand and gravel with negligible fines content will be suitable for shallow infiltration basins
5. For sites consisting of near-surface soils with relatively high fines content (silt or clay), dry wells or infiltration wells will be required
6. Selection the suitable infiltration method
7. Evaluation of site geometry and suitability for construction
8. Conceptual engineering design
9. Engineering cost estimate
10. Cost-benefit evaluation of the specific site location



Mohave County Development Services

# KINGMAN AREA PROJECTS

	Infiltration Projects	Estimated Recharge Capacity AF/Year
1	Kingman Treated Wastewater Recharge	1,200
2	Kingman Monsoon Park at Southern-Eastern Aves	10
3	Kingman Southern Vista & Hualapai Shadows subdivisions stormwater basins	109
4	Kingman Hualapai Foothill subdivision washes	82
5	Kingman Rancho Santa Fe washes	50
6	Kingman SE area BLM Land infiltration basins	178
7	Kingman Rattlesnake Wash infiltration basins	510
8	Kingman West area infiltration basins	93
9	Peacock Nots LLC. Property basins (8 basins)	1,693
10	Bank Street/High School Infiltration Project	200
11	Mohave Wash north of Thompson Ave basin and rechargewell	1,000
	TOTAL	5,125





## Kingman Reclaimed Water Project

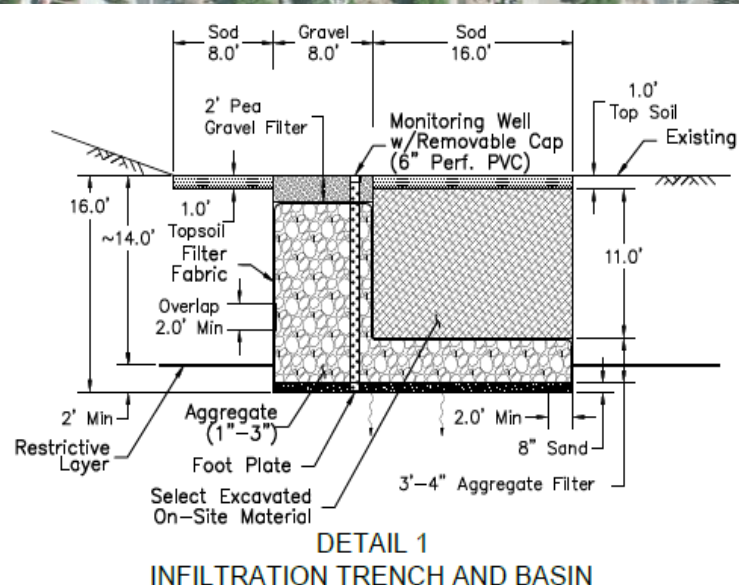


- The City of Kingman is in the process of installing a system for recharging a portion of their treated waste water through an injection well to the aquifer.
- Project completion is anticipated in 2021.
- The cost of the injection well is approximately \$1 Million, and the entire system cost with pumps, piping, contingency, engineering, etc. is about \$1.6 Million.
- The system recharge capacity will be approximately 1,200 AF per year. (That will amount to about 15% of Kingman's average annual water demand of approx. 8,000 AF.)
- There is potential for future expansion with the current approx. 1,800 AF annual output of the Kingman Wastewater Plant coupled with anticipated growth in the coming years.





## Kingman Monsoon Park Infiltration Basin



- Constructed in 2019
- \$ 86,000 with most of the cost for the City Park enhancement





## Existing Detention Basins and Washes within City ROW



The City of Kingman established budget to install dry wells in the subdivisions of:

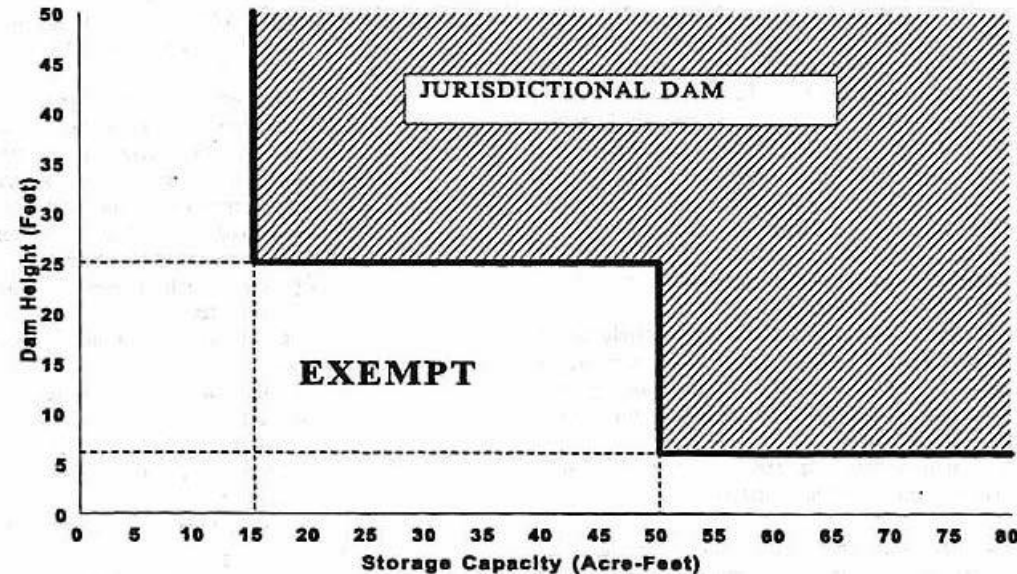
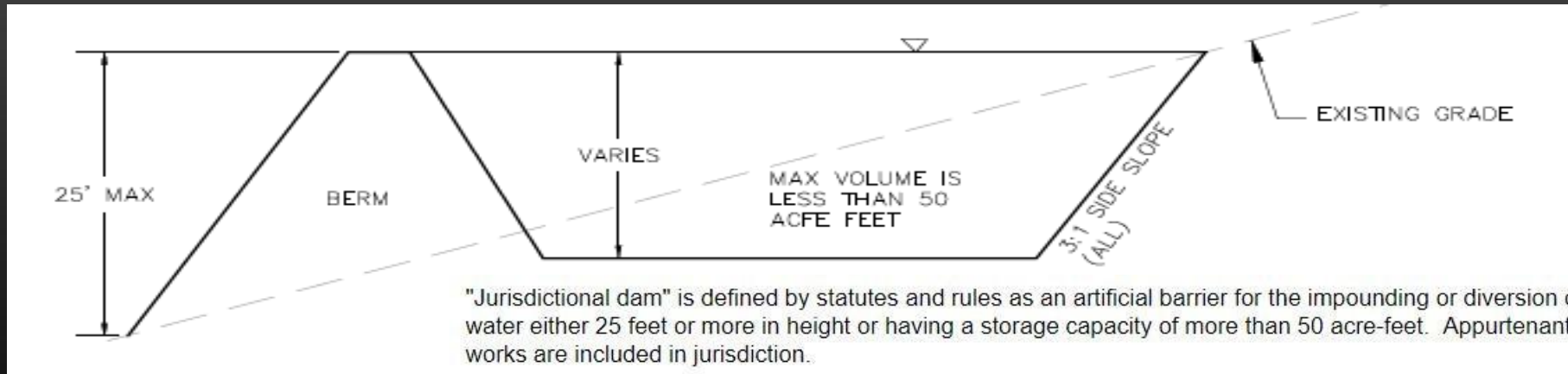
- Hualapai Foothills Estate,
- Southern Vista and
- Hualapai Shadows





Mohave County Development Services

## Basic Infiltration Basin Design Concept



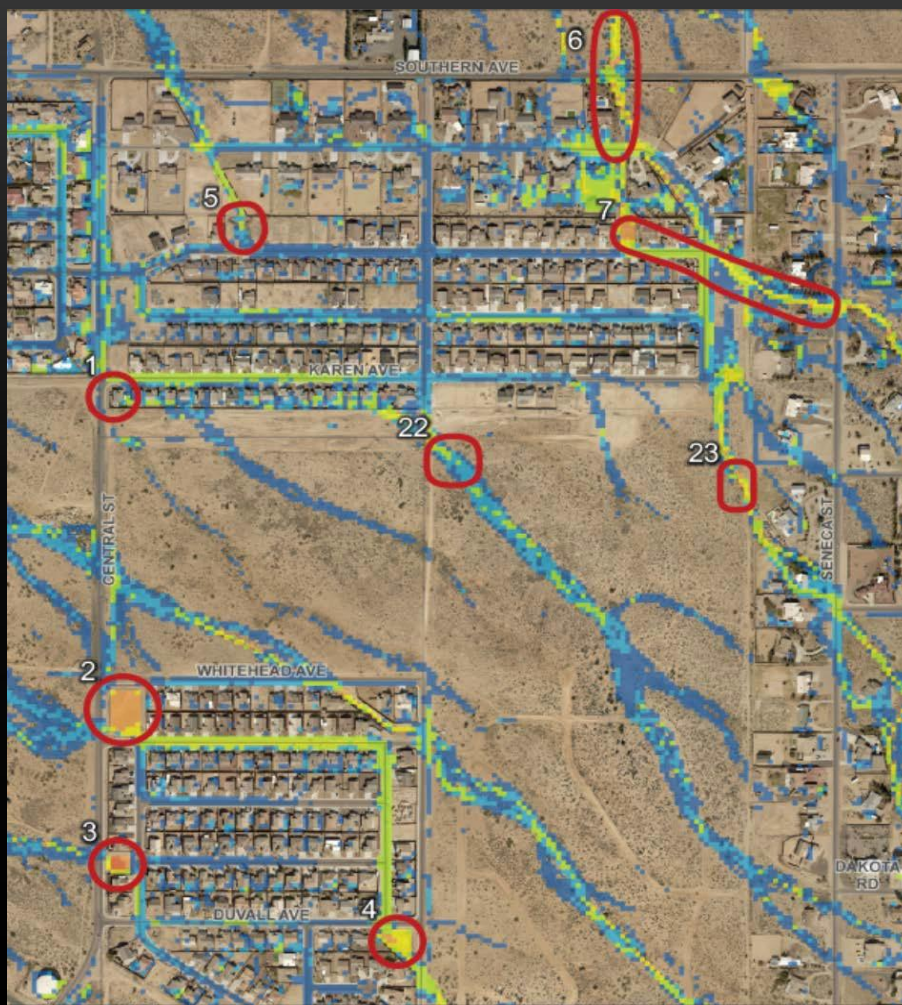




Mohave County Development Services

# Hualapai Foothill Subdivisions Washes

Southern Vista and Hualapai Shadows



Hualapai Foothills Estate





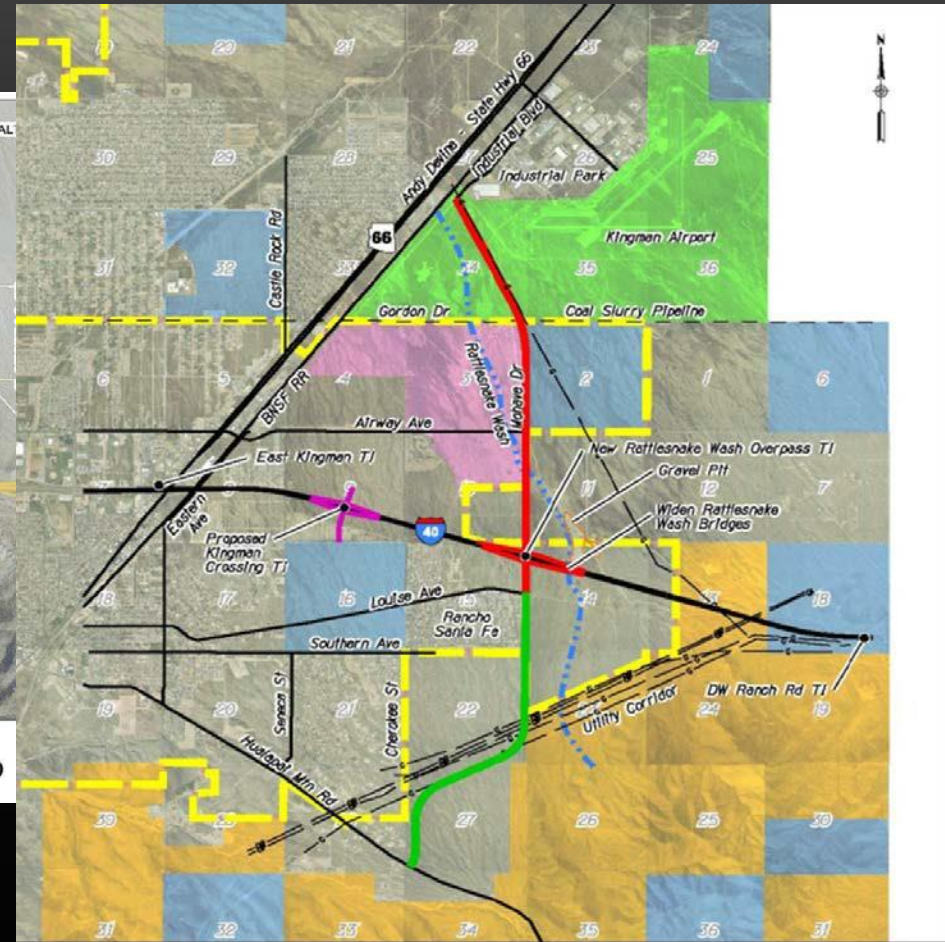


# Rattlesnake Wash Infiltration Basins

Location of Proposed Freeway Interchange



Location Map



## LEGEND

- Kingman General Plan 2020, Parkway Alignment, Phase 1
- Kingman General Plan 2020, Parkway Alignment, Phase 2
- Proposed Kingman Crossing TI and Roadway Extension

- Kingman City Limits
- Section Number
- State Land
- BLM Land
- Proposed Master Planned Subdivision

I-40, Rattlesnake Wash Traffic Interchange Design Concept Report and Environmental Study  
TRACE No. 040 MO 57 HWSA ETL







# Rattlesnake Wash Infiltration Basins

## Proposed Infiltration Basins with alternatives 1 through 3



Basin	10-Year Inflow	10-Year Outflow	Volume Retained	100-Year Inflow	100-Year Outflow	Volume Retained
	(CFS)	(CFS)	(Acre Ft)	(CFS)	(CFS)	(Acre Ft)
A	1,213	0	65	3,494	1,046	84
B	382	0	19	1,201	111	46
C	707	0	25	2,199	31	48

Basin	10-Year Inflow	10-Year Outflow	Volume Retained	100-Year Inflow	100-Year Outflow	Volume Retained
	(CFS)	(CFS)	(Acre Ft)	(CFS)	(CFS)	(Acre Ft)
A	1,213	0	65	3,494	1046	84
B	382	0	19	1,201	111	46
C	707	0	25	2,199	31	48
D (Small)	777	0	68	2,973	526	229

Basin	10-Year Inflow	10-Year Outflow	Volume Retained	100-Year Inflow	100-Year Outflow	Volume Retained
	(CFS)	(CFS)	(Acre Ft)	(CFS)	(CFS)	(Acre Ft)
A	1,213	0	65	3,494	1,046	84
B	382	0	19	1,201	111	46
C	707	0	25	2,199	31	48
E	637	0	64	2,910	616	231



# Kingman Area West Infiltration Basins

## Estimated Quantities

Table 1 – BLM Basin(s) Results

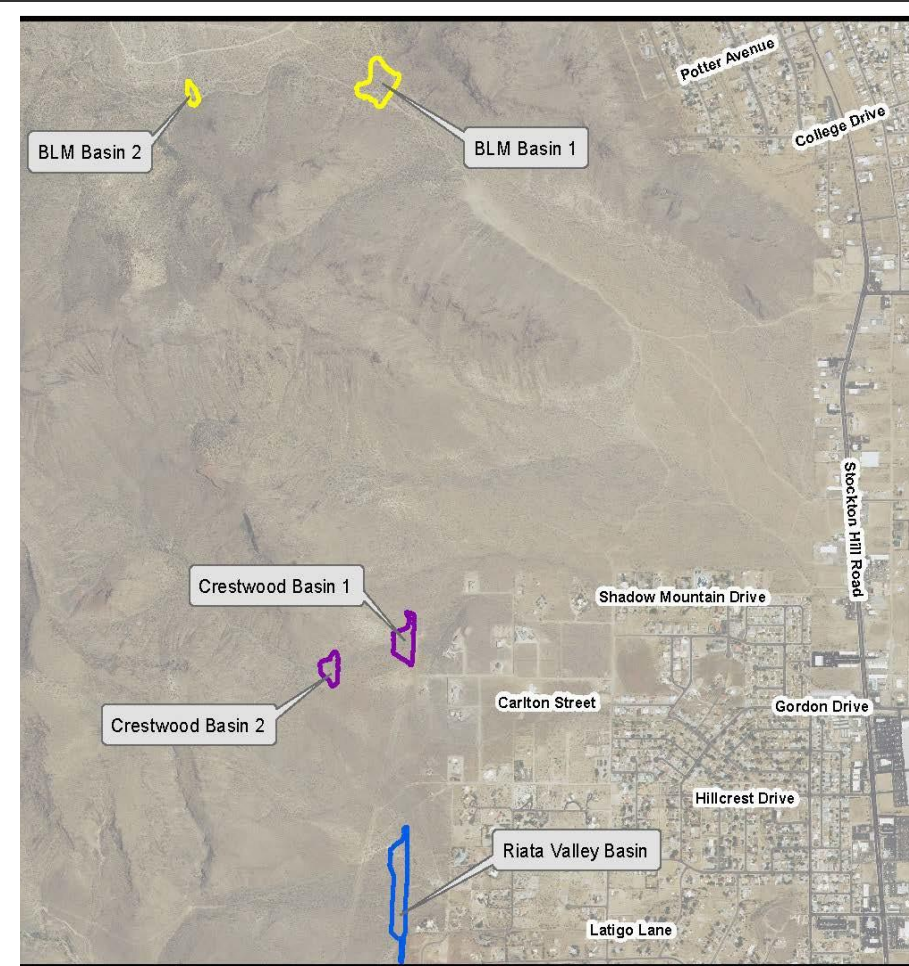
Basin	10-Year Inflow (CFS)	10-Year Outflow (CFS)	Volume Retained (Acre Ft)	100-Year Inflow (CFS)	100-Year Outflow (CFS)	Volume Retained (Acre Ft)
BLM1&2	708	42	32	2,987	1,046	49

Table 2 – Crestwood Basin(s) Results

Basin	10-Year Inflow	10-Year Outflow	Volume Retained	100-Year Inflow	100-Year Outflow	Volume Retained
	(CFS)	(CFS)	(Acre Ft)	(CFS)	(CFS)	(Acre Ft)
CW1&2	283	11	8	1,044	318	17

Table 3 – Riata Basin Results

Basin	10-Year Inflow (CFS)	10-Year Outflow (CFS)	Volume Retained (Acre Ft)	100-Year Inflow (CFS)	100-Year Outflow (CFS)	Volume Retained (Acre Ft)
RIATA	165	24	10	876	160	27







Mohave County Development Services

## Bank St. at Kingman High School Flood Control/Infiltration Basin

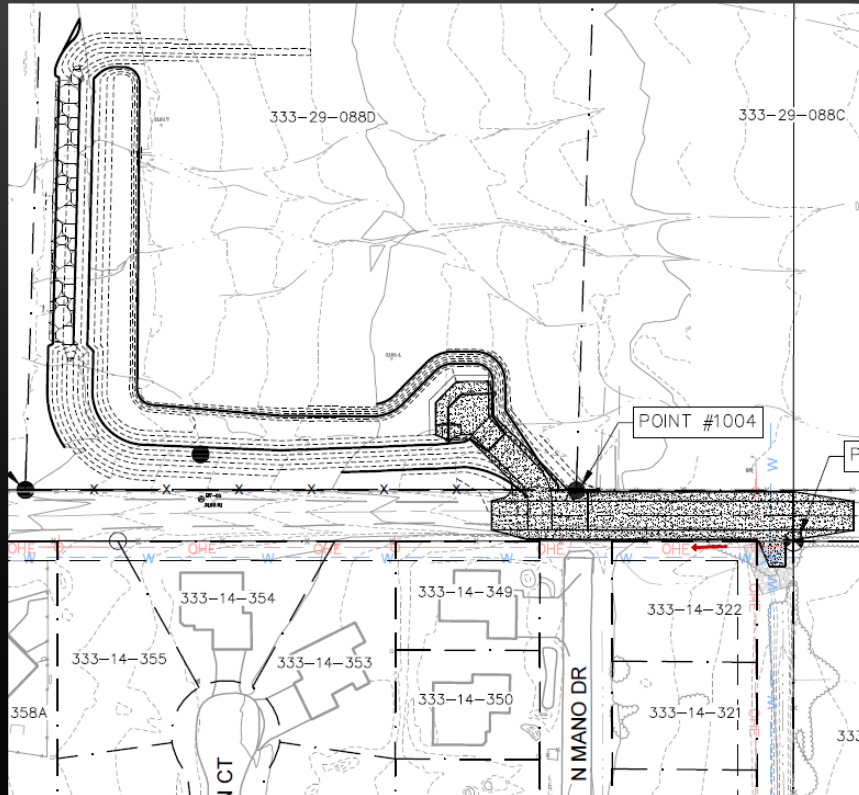
Potential Recharge Site - APN: 324-28-007 & 008



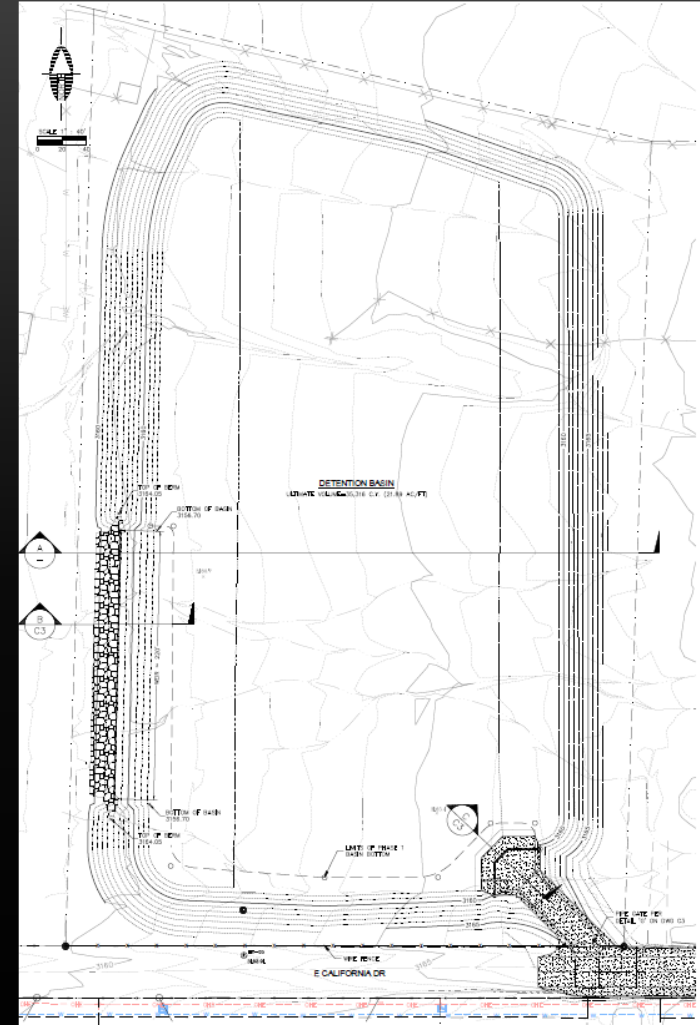




## Valle Vista Flood Control Infiltration Basin



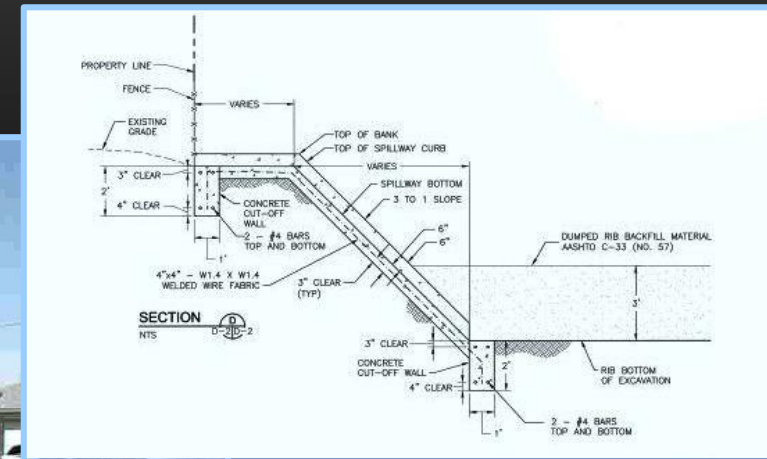
The project is being constructed in cooperation with Mohave County Public Works to reduce future road maintenance and prevent flooding of down-stream areas.





Mohave County Development Services

# Quail Run Flood Control Infiltration Basin Constructed by Mohave County Flood Control District



- Constructed in 2012
- \$ 516,100

## IV. Discussion of Committee Goals





# Committee Goals

- a) To achieve a baseline understanding of Arizona groundwater in Non-Active Management Areas.
- b) To identify and develop voluntary alternatives to address groundwater issues by planning area while protecting individual property rights.
- c) To make recommendations to the full Council for Best Management Practices at the local level.
- d) The further discussion and recommendation of issues that may be brought forward.

## v. Next Steps



## vi. Adjournment

